

SECTION 33 11 00

WATER UTILITY DISTRIBUTION PIPING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Buried pipe and fitting.
- B. Valves.
- C. Fire hydrants.
- D. Thrust blocks and harnessing.
- E. Field quality control.
- F. Test.
- G. System disinfection.
- H. Connections to existing mains.

1.02 RELATED SECTIONS

- A. Trenching, bedding, and backfilling for pipelines are specified in Section 33 05 28 - Trenching and Backfilling for Utilities.
- B. Coordinate the work of this Section with the work of Section 22 11 01 - Water Distribution

1.03 MEASUREMENT AND PAYMENT

- A. General: Measurement and payment for the water distribution system will be either by the lump-sum method or by the unit-price method as determined by the listing of the bid item for the water distribution system indicated in the Bid Schedule of the Bid Form.
- B. Lump sum: If the Bid Schedule indicates a lump sum for the water distribution system, the lump-sum method of measurement and payment will be in accordance with Section 01 20 00 Price and Payment Procedures, Article 1.03.
- C. Unit price: If the Bid Schedule indicates a unit price for the water distribution system, the unit-price method of measurement and payment will be as follows:
 - 1. Measurement:
 - a. Water distribution system will be measured for payment by the linear foot of pipe, installed in place, tested and disinfected, for each type and size of pipe, along the centerline of the pipe with deductions made for manholes or other structures, measured from the inside face of each structure.

- b. Utility structures will be measured separately for payment as specified in Section 33 05 16, Utility Structures.
 - c. Pipe fittings, valves, joints, pipe bedding, collar taps, and cutting of pipe will not be measured separately for payment, and all costs in connection therewith will be considered as included in the linear foot measurement for pipe.
 - d. Fire hydrants will be measured for payment by the individual unit (each), installed in place and acceptably tested.
 - e. Support of trench excavation, maintenance, support of existing utility facilities, grading, excavation and backfill, cast-in-place concrete, and incidental work pertaining to the installation of pipe will not be measured separately for payment, but will be considered as included in the linear foot measurement for pipe.
2. Payment: The water distribution system will be paid for at the indicated Contract unit prices for the computed quantities as determined by the measurement method specified in Article 1.03.C.1.

1.04 REFERENCES

A. American Society for Testing and Materials (ASTM):

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| 1. | ASTM A126 | Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings |
| 2. | ASTM A197 | Specification for Cupola Malleable Iron |
| 3. | ASTM A307 | Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile |
| 4. | ASTM D1784 | Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds |
| 5. | ASTM D1785 | Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120 |
| 6. | ASTM D2466 | Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40 |
| 7. | ASTM D2564 | Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings |
| 8. | ASTM D2855 | Practice for Making Solvent-Cemented Joints, with Poly (Vinyl Chloride) (PVC) Pipe and Fittings |
| 9. | ASTM D3139 | Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals |
| 10. | ASTM F439 | Specification for Socket-Type Chlorinated Poly (Vinyl |

Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80

11. ASTM F477 Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

B. American Water Works Association (AWWA):

1. AWWA C500 Gate Valve, 3 through 48 inches NPS – for Water and Sewage System
2. AWWA C503 Standard for Wet-Barrel Fire Hydrants
3. AWWA C504 Rubber Seated Butterfly Valve
4. AWWA C508 Swing-Check Valves for Water Works Service, 2 inches through 24 inches NPS
5. AWWA C606 Grooved and Shouldered Type Joints
6. ANSI/AWWA C651 Standard for Disinfecting Water Mains
7. ANSI/AWWA C900 Specification for Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. through 12 in. for Water Distribution

- C. Water Utility District Standards: Note that all work shall be performed and completed in accordance with the jurisdictional water utility district's standard drawings and specifications. The Contractor shall be responsible for obtaining all such standards and for compliance with such standards as applicable.

D. Underwriters Laboratories Inc. (UL):

1. UL 246 Hydrant for Fire-Protection Service

1.05 SUBMITTALS

- A. Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.
- B. Submit respective manufacturer's product data for manufactured materials and equipment, including all valves and fire hydrants.
- C. Submit Shop Drawings showing piping layout and pipe, valves, hydrants, and locations of tie-ins, buttresses, and thrust blocks.

1.06 SUBMITTALS FOR CLOSEOUT

- A. General: Refer to Section 01 77 00 - Closeout Procedures, and Section 01 78 23 - Operation and Maintenance Data, for submittal requirements and procedures.

- B. Record Drawings: Record actual location of piping mains, valves, connections, and invert elevations for review.

1.07 SITE CONDITIONS

- A. Excavations in which products will be buried shall be dry.
- B. Coordinate the installation of the water supply system with the jurisdictional water utility owner.
- C. The jurisdictional water utility district shall provide water services to the water meters' points of connection for station facilities and landscape irrigation systems, and modifications to existing water mains, as indicated on the Contract Drawings. The Contractor shall be responsible for making all such arrangements.

PART 2 - PRODUCTS

2.01 BURIED PIPE AND FITTINGS

- A. Requirements: Provide the types, sizes, and configurations of pipe, fittings, and miscellaneous materials and installation accessories as indicated.
- B. PVC Pipe and Fittings, 3 Inches and Smaller:
 - 1. Pipe: Polyvinyl chloride (PVC), ASTM D1785, Schedule 40 or 80, as indicated, Type I, Grade 1.
 - 2. Fittings: ASTM D2466, socket weld, same material and schedule as pipe, or meeting requirements of ASTM F439, as applicable.
 - 3. Joints: Socket welded with PVC solvent cement conforming to ASTM D2564 and ASTM D2855.
- C. PVC Pipe and Fittings, 4 Inches and Larger:
 - 1. Pipe: AWWA C900, Class 200, polyvinyl chloride (PVC) water pipe with bell and spigot ends and flexible ring joints.
 - 2. Fittings: ASTM D1784, Type 1, Grade 1, polyvinyl chloride (PVC) fittings, Class 200, or meeting requirements of ASTM F439, as applicable.
 - 3. Joints: ASTM D3139, gasketed bell joints with ASTM F477 gaskets.

2.02 VALVES

- A. Gate Valves:
 - 1. Gate Valves up to 2-1/2 Inches: 150 pound bronze body, non-rising stem, single wedge, threaded connection.

2. Gate Valve 3 Inches and Over: AWWA C500, iron body, bronze trim, non-rising stem with square nut, single wedge, mechanical joint ends with type gland and serration's designed for plastic pipe service.
- B. Pressure Reducing Valves: All bronze construction, spring-loaded, single-seated, suitable for tight shutoff under dead-end conditions. Provide with renewable composition seat discs, nylon inserted diaphragm, bolted spring chamber, and threaded connection.
- C. Backflow Preventer: Provide a device that is approved by the jurisdictional water utility company. As a minimum, the backflow preventer shall be a reduced pressure principle assembly with two rising-stem gate shut-off valves, two resilient seat ball-valve test cocks, two check valves replaceable resilient disks and seat with relief valve with replaceable seat. Backflow preventer shall be suitable for 175 psig operating pressure and 140 degrees F operating temperature, and shall be of bronze construction with bronze internal parts and stainless steel springs, screwed inlet and outlet for 2-inch and smaller sizes, and cast iron, epoxy-coated construction with 150 pound flanged inlet and outlet for 3-inch and larger sizes.

2.03 FIRE HYDRANTS

- A. Provide fire hydrants and related appurtenances as indicated. Fire hydrants shall comply with the requirements of the jurisdictional authority and the standard drawings and specifications of the jurisdictional water utility district, as applicable.
- B. Fire hydrants shall meet the requirements of AWWA C502 and UL 246, as applicable, and shall be wet barrel type, as a minimum, with a minimum of two discharge nozzles of size(s) required by the jurisdictional authority.

2.04 CONCRETE FOR THRUST BLOCKS

- A. Provide Class 3000, 1-inch aggregate, concrete for all thrust blocks, as specified in Section 03 05 15 - Portland Cement Concrete, with reinforcement where indicated.

2.05 MISCELLANEOUS METAL

- A. Tie Rods: Stainless steel, Type 316, threaded ANSI standard, bolt threaded on both ends. Minimum 1/2-inch diameter for 4-inch pipe, 5/8-inch minimum diameter for 6-inch and 8-inch diameter pipe, and 3/4-inch minimum diameter for 12-inch and larger.
- B. Rod Couplings: Malleable iron, ASTM A197, turnbuckle design, female threaded to mate with tie rods, 5/8-inch and 3/4-inch sizes to mate with both rods and mechanical joint bolts.
- C. Pipe Clamps: For sizes 4 inches and larger, provide with malleable iron rod sockets. Provide washers in lieu of rod sockets where authorized, conforming with ASTM A126, Class A, cast iron. Bolts and bolting shall conform with ASTM A307.

PART 3 - EXECUTION

3.01 MAINTAINING WATER SERVICES

- A. Maintain water service and conduct operations at times selected to minimize the duration and inconvenience of service interruption.

- B. At least 24 hours prior to the required cutting or abandoning of an existing water main, notify the jurisdictional water utility owner, and obtain approval of the schedule. Actual cutting or abandoning of an existing water main shall be performed by the Contractor after receiving approval from the owner of the facility.
- C. Keep existing water mains parallel to new water mains in service until new water mains are ready for service.
- D. Where the existing water main or service is to be cut for connection to new piping, the work shall be performed by the Contractor. Initial work operations shall include the test-pitting of all points of connection (tie-in) to ensure the true location of existing linework.
- E. Water valves in service shall be operated only by personnel of the jurisdictional water utility owner.
- F. Except as specified otherwise herein, construction methods shall be in accordance with the applicable provisions of the jurisdictional water utility owner's standard drawings and specifications.

3.02 INSTALLATION

- A. Installation Requirements:
 - 1. Excavate pipe trench in accordance with Section 33 05 28 - Trenching and Backfilling for Utilities. Hand trim bottom of trench to approximately 6 inches below invert of pipe.
 - 2. Top of pipe to finished grade shall be 30 inches unless otherwise indicated or approved by the Engineer.
 - 3. Place sand bedding material, meeting the requirements of Section 33 05 28 - Trenching and Backfilling for Utilities, at trench bottom, level in one continuous layer not exceeding 8 inches in compacted depth. Compact bedding to 95 percent relative density.
 - 4. Backfill around sides and to 6 inches above pipe with cover fill tamped in place and compacted to 95 percent relative density.
 - 5. Test pipe distribution system and place tracer wire on top of pipe as specified herein prior to covering pipe. Backfill trench in accordance with Section 33 05 28 - Trenching and Backfilling for Utilities.
 - 6. Maintain optimum moisture content of bedding material to attain required compaction density.
 - 7. Provide concrete thrust blocks for elbows, tees, valves, and appurtenances of buried piping. Thrust blocks shall be constructed as indicated and in accordance with AWWA requirements.
 - 8. Install piping true to line and grade, supported and guided to assure alignment under all conditions.

9. Install pipe to allow for expansion and contraction without stressing pipe or joints.
10. Install unions at each connection to valves, both sides of each valve.
11. Make change in line with fittings. Do not spring joints to effect change of direction.
12. Do not field cut pipe unless necessary. Make such necessary cuts by means of equipment designed for the purpose, ensuring a smooth and square end.
13. For connection to existing pipe, provide pipe with suitable ends or adapters, after verification of size and type of existing pipe.
14. Install tie rods and pipe clamps at every joint fitting and valve.

B. Valves:

1. Install valves in accordance with the valve manufacturer's installation instructions.
2. Where valves are provided by the jurisdictional water utility owner, provide suitable access for performance of such work.
3. Where necessary, alter the typical valve manhole to suit actual conditions. Any alterations in valve manholes shall be operable from the street level. All operator nuts shall be plumb to the valve manholes.
4. Set valve on solid bearing.
5. Center and plumb valve box over valve. Set box cover flush with finished grade.

C. Fire Hydrants:

1. Provide fire hydrant installations as indicated. Installation shall conform with requirements of the jurisdictional fire department and the water utility owner's standard drawings and specifications.
2. Provide necessary appurtenances and accessories as required to complete the installation.
3. Paint hydrants in accordance with applicable requirements of Section 09 91 00, Painting.
4. Set hydrants plumb, locate pumper nozzle perpendicular to and facing roadway.

D. Thrust Blocks and Harnessing:

1. Provide for counteracting thrust caused by static and dynamic forces, including water hammer at bends, tees, reducers, valves, and dead-ends by installing harnessing as indicated or required. For other methods, submit details for approval of the jurisdictional water utility owner prior to use.
2. Provide concrete thrust blocks as indicated where harnessing is not practicable.

- E. Water Service Connections: Provide water service connections, where necessary, in accordance with the California Plumbing Code, the installation instructions of the service pipe and fittings manufacturer, and the utility company requirements with reduced pressure back-flow preventer and water meter with by-pass valves.
- F. Acceptance Requirements: After installation of pipes, ends of pipes shall be either capped or plugged. No piping shall be buried before being inspected and tested.

3.03 FIELD QUALITY CONTROL

- A. Refer to Section 01 43 00 - Quality Assurance, for requirements.
- B. Compaction testing of related earthwork shall be performed in accordance with applicable requirements of Section 31 00 00 - Earthwork.
- C. If tests indicate work does not meet specified requirements, remove such work, replace, and retest at no additional cost to the District.

3.04 TESTS

- A. Protection from Flooding: Provide positive measures to protect exposed, installed pipe and compacted pipe bedding from flooding during testing.
- B. Notice of Testing:
 - 1. Give 48 hours notice of intention of testing to the jurisdictional water utility owner, which will furnish, install, and operate pumps, gages, meters, and individual pipe connections to test openings.
 - 2. Designate largest sections feasible for testing and sterilizing. Testing and sterilizing operations shall be performed by the Contractor; at Contractor's expense.
- C. Testing Requirements:
 - 1. General:
 - a. Prior to backfilling, isolate the system by use of approved valves, caps and plugs, or other acceptable methods.
 - b. Maintain such isolation throughout the performance of leakage and pressure testing.
 - c. Where valves are used for isolation, eliminate leakage through such valves if it occurs. Maintain new work isolated from existing water mains, except for test connections, until testing and sterilization have been completed.
 - 2. Hydrostatic Tests:
 - a. For hydrostatic tests, provide approved caps and plugs in sections to be tested, and remove them after testing.

- b. Prevent leakage in pipes and fittings at openings. Temporarily block plugged and capped ends to prevent displacement.
- c. Install the water source connection for testing the isolated section. The Engineer may permit the use of a tap that will be furnished and installed by utility owner.
- d. Provide labor and materials required for leakage testing, including excavation for installation and removal of pumps, gages, meters, and water source connections.
- e. Where leakage exceeds the water utility company's standards, perform necessary corrective measures.
- f. Remove and replace defective pipes, joints, fittings, valves, and other appurtenances. Reset such items if displaced.
- g. Perform hydrostatic tests in accordance with the jurisdictional water utility district's requirements. All such tests shall be witnessed by the jurisdictional water utility district's representative. The Contractor shall be responsible for making all such arrangements.
- h. Remove and replace defective pipe, joints, fittings, valves, and other appurtenances. Reset such items if displaced.

D. Testing and Flushing of Potable Water System: Test the potable water system hydrostatically in sections to a pressure of at least 150 psi for not less than 15 minutes, witnessed by the Engineer. Pressure test pipe before burial. Repair leaks and retest the system until the system is leak free. Use testing instruments calibrated by a qualified laboratory in accordance with Section 01 45 00 - Quality Control. Test sequence shall be as follows:

- 1. Lines shall be fully flushed.
- 2. Lines shall be hydrostatically tested.
- 3. Lines shall be fully flushed.
- 4. Lines shall be fully disinfected.

3.05 SYSTEM DISINFECTION

A. Before final acceptance of the water supply system, each section of the new line shall be disinfected in accordance with ANSI/AWWA C651. One of the following sources of disinfectant shall be used:

- 1. Mixture of water and chlorine gas;
- 2. Direct application of chlorine;
- 3. Mixture of water and calcium hypochlorite; or
- 4. Mixture of water and calcium chloride.

- B. Before disinfecting, flush the line thoroughly to remove dirt and extraneous materials. Clean each section of the line between valves independently.
- C. Retain the disinfectant solution in the pipe for at least 24 hours. Following this sterilization period, the residual chlorine content at the ends of the section and at other representative points shall be not less than five parts per million. Then, the line shall be drained and thoroughly flushed with water until the residual chlorine content is similar to that obtained from the existing water distribution system.
- D. Take water samples and test in accordance with ANSI/AWWA C651.

3.06 CONNECTIONS TO EXISTING MAINS

- A. Following testing and sterilization, new water distribution lines shall be connected to existing mains as indicated. Each connection shall be made at a time and in a manner that will result in the least interruption of service.
- B. All connections involving shut down of jurisdictional water utility's existing facilities shall be made under the immediate supervision of the jurisdictional water utility district. No member of the Contractor's forces may operate any valve controlling the flow of water in the water utility's existing system.
- C. The Contractor shall provide tie-ins to the existing system at a time that is convenient to jurisdictional water utility district, which may be in the evenings and on weekends.

END OF SECTION 33 11 00